

# NATIONAL



# RADIO NEWS



**FROM N. R. I. TRAINING HEADQUARTERS**

Vol. 2—No. 6

WASHINGTON, D. C.

JANUARY, 1930



15<sup>th</sup> ANNIVERSARY  
NUMBER

## BANNER RADIO YEAR AHEAD



**F**ROM all indications 1930 will be Radio's Banner Year. It will offer more in Radio opportunity than at any time in the past. Here are some of the reasons why N. R. I. men can count on a big year right ahead—

First, there is Television. Some have felt that Television would be in the homes by this time, but the more conservative of us have always believed that the Radio public wants Television to be just about perfect before taking it on. Television has been in the laboratory for some time—the kinks

are being taken out of it. Around 20 stations are broadcasting television, several firms are manufacturing kits, and even Televisors, and it is practically a certainty that it will be introduced to the public on a commercial scale very shortly. Doubtless, 1930 will see marked development in that field.

Then, the sound engineering field will continue to make increased demands for men with a knowledge of Radio's basic principles. The country is going "talkie." Public address systems and sound projection apparatus will be installed in thousands of theatres, auditoriums, amusement centers and other places through the year. N. R. I. men should get their share of this work.

Here is another factor that will make 1930 a big year in Radio. The public has been pursuing a policy of watchful waiting—delaying their buying of Radio apparatus until they are satisfied that receivers have been standardized and that their new set will not become obsolete over the week-end. That stage has been reached in Radio today. Set design is fast becoming standardized. The new sets equipped with remote control and other features should appeal to the buyer. There are over 14,000,000 wired homes that today are without adequate socket power operated sets. Improved types of battery receivers are available for the unwired home. So it looks like a big year in sales, service, and repairs.

International broadcasting will be on a broader scale than ever this year. Arrangements have been made between the American chains and the broadcast companies in England, France, Germany and other continental countries for more frequent interchange of programs, and American audiences will very shortly have the privilege of listening often to the best productions rendered by European Symphony orchestras.

The use of Radio in Aviation will expand in 1930. Government plans call for an enlargement of the Radiobeacon system to make safe our trans-continental passenger and mail lines. Hundreds of point-to-point stations are being constructed to provide weather information and other data to planes in flight. Point-to-point land Radio communication will be advanced. So it's clear that this is going to be one of the biggest years yet for the man who knows Radio, and when next Christmas rolls around I'm sure that N. R. I. men will have reaped a full measure of Radio's prosperity.

J. E. SMITH.

## Synchronism — One of Television's Problems

By S. H. ANDERSON

Radio Engineer

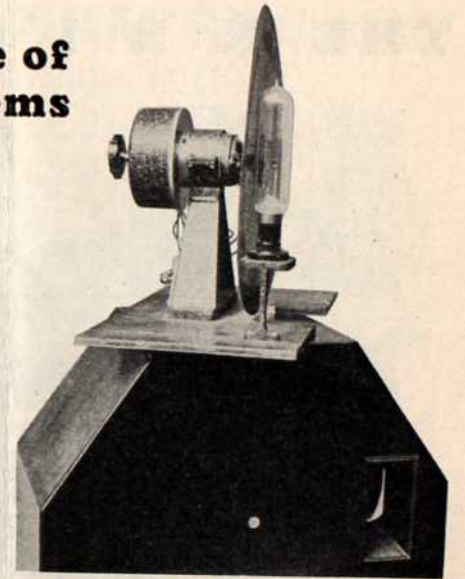
Clarostat Manufacturing Company



**T**HERE appears to be little difficulty in picking up television signals in almost any part of the country, because of the dozen or so television broadcasting stations. However, many experimenters complain about the difficulty of unscrambling the whirling dots so as to obtain satisfactory images. The trouble is, therefore, one of synchronization, or matching the speed of the receiving disk with that of the transmitting disk.

Certain television workers recommend synchronous motors. This practice is ideal in certain areas served by the same alternating current power system. The same alternating current supply insures absolute regulation of both transmitting and receiving disks operating on the common power supply. However, when the transmitter and receiver are located in different power supply areas, the synchronous motor is no longer such a happy solution. The use of a synchronous motor with friction drive, as recommended by Jenkins in particular, does not prove so effective in most cases, because of the slippage between driving and driven disk.

The leading television workers have found the variable resistance method of controlling speed the most satisfactory. Here the problem is to have a variable resistance that is stepless, so as to obtain precise speed adjustment, together with a steady resistance value at any setting. The problem of developing a suitable micrometric resistance has been far from simple, for most variable resistors are not intended for handling the considerable current called for in a motor control application. Nevertheless, by certain detail changes in our power clarostat, we have succeeded in evolving a device that provides the necessary stepless resistance range, together with a current handling capacity of 80 watts, or more than ample to control the usual motor of  $\frac{1}{8}$ th horsepower or less.



The first picture of the Baird televisor which is in use in the British Isles. Steady, sure progress is being made in Television and it will pay every wide-awake Radio man to keep his eyes on that field. Nothing can stop it—television is right ahead of us.—J. E. S.

With the power clarostat, it is relatively simple to bring the scanning disk into step. By studying the pattern of whirling dots, and regulating the speed up and down, one soon becomes aware of whether the speed is too fast or too slow. The shifting of the pattern to one side or to the other indicates the speed of the receiving disk with relation to the transmitting disk. The speed is gradually adjusted until the dot patterns become solid masses and these masses evolve into animated subjects. The speed is readily held by means of the accelerating button which simply short circuits the power clarostat.

The handiest form is the speed control clarostat, mounted in a metal case complete with accelerating button. However, where the disk is mounted in a wooden cabinet, the power clarostat can be suitably mounted with just the knob and the accelerating button exposed.

Aside from the problem of synchronization, there is nothing very complicated about television reception, particularly the simple radio movies of black-and-white silhouettes broadcast by C. Francis Jenkins from W3XX in Washington, D. C. Television signals, when handled on short waves, can be received at distances of several hundred miles with any short-wave set and suitable amplifier. While the pictures themselves are of little intrinsic interest, the novelty of receiving pictures through space makes such experimental work quite thrilling.

# THE N R I CELEBRATES



In the little room shown in upper left-hand corner the first N.R.I. class met back in 1914. Below is shown a section of the Student Service Department of the Institute today. In other parts of our two-story home are housed the Graduate, Employment, Stenographic, Publicity and other departments. The helpful service that my staff renders, enables N.R.I. men to go farther in Radio and is also responsible for the growth of the N.R.I.—J. E. S.

**FIFTEEN** years ago the National Radio Institute was founded. Mr. Smith and Mr. Haas equipped a little 10x12 room with a code machine and started out with a class of four students. That was six years before the first broadcast station was built. Radio sets, as we know them today, were unheard of. Indeed, there was little to encourage the founders. Even their friends laughed and said that wireless was just a fad that would soon be forgotten.

But Mr. Smith and Mr. Haas foresaw a huge industry in the making that would offer unbounded opportunities to trained men—yes, they envisioned a world in which Radio would play a dominating part. Their prophecy has come true.

And, along with Radio's giant strides the N. R. I., pioneer Radio home study Institute, has grown. The success of the thousands of ambitious men it has trained and is today training has made possible the growth and widespread fame of the Institute.

The Institute today occupies its own beautiful building on 16th Street, Washington's finest. It's Instruction, Service and Administrative staffs occupy the 12,000 feet of floor space. A trained staff of 125 assist President Smith, Vice-President Haas and Chief Instructor Dowie in giving every possible service and assistance to N. R. I. men the world over.

Never before has the Institute been so ably equipped to train men for the Radio field. Never before have Radio opportunities been so abundant. President Smith sums it up in these words: "Little did I realize when I faced the first class of four students that I would have the opportunity of fitting many thousands into profitable Radio work, and on this 15th Anniversary of the founding of the Institute I want to pledge anew my faith in the future of Radio and of the man who faces it with firm, technical training."

# FIFTEENTH ANNIVERSARY

## Leaders In Radio Congratulate NRI And Point To Big Future Of Trained Man



shoulders can be

On the occasion of the Fifteenth Anniversary of the founding of the National Radio Institute, I should like to extend my heartiest congratulations.

No man familiar with the amazing and steady growth of the Radio industry throughout recent years can doubt for a moment that the successful solution of the many engineering and servicing problems attendant upon this rapid growth has been tremendously facilitated by the work of your Institution in providing for manufacturers a source of trained young men, upon whose shoulders many responsibilities.

McMURDO SILVER,  
SILVER MARSHALL, INC.

Only one home out of four is now equipped with a Radio. Three-fourths of the sets now in use are obsolete, so it would seem that the surface has barely been scratched and the future of the Radio business is bright for years to come. There is a growing demand for trained Radio men in this great industry.

POWEL CROSLY, JR.,  
PRESIDENT,  
CROSLY RADIO CORP.

We need man-power to continue operating on our present knowledge and we need man-power to learn more about this remarkable science of which we have merely scratched the surface. Radio's greatest need today from the technical side is capable, well-trained men.

WILLIAM S. PALEY, PRESIDENT,  
COLUMBIA BROADCASTING SYSTEM.



At no time during the past has the future looked so bright for the seeker of Radio knowledge as at present. In the past, Radio has come through vast revolutionary changes and the last fifteen years were really a period of preparation for the Radio industry. Right now is the time that every able-minded and able-bodied radio man begins to cash in on his Radio knowledge. In the Radio servicing field, in Radio Sound Engineering, in Television there is a tremendous opportunity—far greater than at any time during the past fifteen years. At this moment, there is a great scarcity in Radio service men and Radio sound engineers and with the coming of Radio equipped automobiles during the next few months this scarcity will become more acute.

HUGO GERNSBACH,  
EDITOR, RADIO-CRAFT.

Radio has broadened of late years, into a means of entertainment as well as of communication. Its methods are of increasing value in numerous fields. It offers a multitude of opportunities to men who are not afraid of hard work in pioneer directions. It is believed that the years will bring an ever increasing number of openings for men trained in the various subdivisions of Radio Engineering and its applications.



A. N. GOLDSMITH,  
VICE PRESIDENT,  
RADIO CORP. OF AMERICA.

The future of Radio with its wonderful opportunities of development into the unknown fields of public service depends upon the ability of men. Only trained men with vision can delve into the unknown with success. I believe that the Radio industry is the most interesting and most progressive of all. It is interesting because of its great public service and it is progressive because it is new and many of its most important problems remain unsolved.

M. H. AYLESWORTH, PRESIDENT,  
NATIONAL BROADCASTING CO.



Congratulations on completion of fifteen years of training men for Radio work. There is every reason to expect Radio to continue to extend its usefulness as it has in the past. Your contribution to this growth is an essential one, since modern civilization increasingly depends upon the man with specialized training.

J. H. DELLINGER, Director,  
RADIO LABORATORY,  
BUREAU OF STANDARDS.

Heartly congratulations to the Institute on the remarkable work being accomplished. I wish to compliment the graduates and students on their commendable efforts in seeking more knowledge in this highly technical field. Radio needs the American youth as inventor, technician and expert, and a technical education is vital.

PAUL A. GREEN, CHIEF ENGINEER,  
COLUMBIA BROADCASTING SYSTEM.

The Radio industry during 1930 must take television seriously. With the inauguration of television transmitting stations, operating on a regular schedule, there is certain to be widespread interest in television reception. Vast experimental possibilities are at hand. And so the industry must provide the necessary components at first, followed by kits and then practical televisions, finally leading to the refined televisor which will be incorporated in the same cabinet as the sound broadcast receiver. 1930 will be the first television year.

C. FRANCIS JENKINS,  
JENKINS TELEVISION CORP.





Cash in on the farm market. Too many farm homes are equipped with old, out-of-date sets. They need the new modern sets more than ever now. A number of manufacturers are designing special equipment for the farmer, and it will pay N. R. I. men in the rural sections to take advantage of the rich farm market now opening up.



By E. A. NICHOLS  
Vice President  
Radio-Victor Corporation  
of America

## SELL THE FARMER—

RADIO means even more to the rural home than to the city home. To the farmer, radio spells a vital business service just as much as entertainment for leisure moments; and recently, broadcasting stations have come to recognize the farm listener as an important part of their listening audience, so that agricultural programs have been developed to a remarkable degree.

The radio industry has not forgotten the rural home. Radio engineers have turned to the requirements of the un-electrified home, eager to duplicate in that field what has been achieved for city and town radio enthusiasts. They have evolved new and refined types of loud speakers capable of supplying ample volume and rich tone from a minimum input. Because of the relative inefficiency of loud speakers in the past, it has been necessary to employ more tubes with a larger current drain. A small increase in drain means a considerable decrease in battery life. Hence battery sets of the past have not been very economical, unless loud speaker volume and tone were lowered.

The recent development of the screen-grid tube, with an amplification factor several times that of the usual three-element or standard battery tube, has also been a step in the direction of the ideal battery set. Indeed, with a single screen-grid tube replacing between two and three of the usual tubes for the radio frequency end, and, when also used as the detector, replacing the first audio tube as well, battery current has been reduced to new low levels. These current economies on the one hand, combined with the possibilities of greater

volume and better tone through refined loud speaker design, on the other, have made possible a battery-operated radio set about on a par with the average socket-power radio set, plus the advantage of a noiseless background for tuning distant stations which is so important for the listener who is a considerable distance from the centers of population.

The combined engineering and research forces of the Radio Corporation of America, the General Electric Company and the Westinghouse Electric & Manufacturing Company, have been at work on this new conception of an efficient battery-operated radio receiver. After many months of intensive effort, such Radiolas have been developed, and will soon be made available. These new sets will not be simply revamped versions of old storage battery or dry battery radio sets. Instead, they will be entirely new conceptions of battery-operated sets, designed to establish rural selectivity, simplicity, economy, tone and radio more on a par with metropolitan radio. In the matters of sensitivity, power, there will be little more to ask for. **SELL THE FARMER!**

"I have built quite a few sets besides service work. Some weeks I make as high as \$25.00 in a few hours spare time."—Lynn Henderson, 817 Elgin Court, Jackson, Mich.

"I have the agency for three of the best standard Radios and I purchased a Supreme testing outfit—built me a work bench and put in a stock of equipment. The result is work and more of it. I am clearing around \$15 a day."—Jesse A. Still, Beach, North Dakota.

# Radio-Trician's Service Manual

on

## Zenith Models 52, 53, 54, 522, 532, 542

The Zenith 50 series circuit incorporates three stages of audio frequency amplification. The first stage is resistance coupled, the second, push-pull using two 227 tubes and the third, also push-pull using two 245 tubes. Only two push-pull transformers are shown in the diagram, the third being in the speaker. The plate circuit from the output or third transformer is completed through the cable provided with the 5-prong plug.

The grid bias for all tubes excepting the UX-245 or C-345 tubes is obtained by usual voltage drop through resistances connected between cathode and ground. .2 condensers are connected across the resistors.

Instead of the usual grid leak and condenser in the detector grid circuit, the linear detection method is used. This consists of a 50,000 ohm resistance paralleled with a .2 condenser between detector cathode and ground. This method allows a greater amount of volume input to the detector tube without blocking or distorting as is the case with the other methods of detection.

The circuit diagram of Models 52, 53, 522, 532 is shown in the Figure 1. Models 54 and 542 use exactly the same diagram with the exception that there is a two-point switch in the grid circuit of the first tube which disconnects the inductance coil from the circuit and connects one side of the loop aerial to the grid of the first tube. The other side of this loop is grounded to the chassis. The power pack used in these models is shown in Figure 2.

### To Remove Chassis From Cabinets

First, remove the two lower screws in the escutcheon plate. These secure the escutcheon plate to the chassis and if not removed before attempting to move the chassis, damage to the escutcheon plate will result.

Second, remove the four bolts running up through the cabinet shelf into the bottom of the chassis.

Third, make certain all wires fastened to binding posts are removed. Also remove the multicable running from the power unit to the chassis. This is done by loosening the nine screws on the contact strip and slipping the terminal strip to the right. Make certain the dial light

bracket is slipped out of its holder so as to prevent damage. The plug connections should be pulled from their sockets.

Fourth, loosen the two hexagonal head set screws holding the coupling between the automatic tuner and the tuning condenser shaft.

NOTE: Do not remove the large hexagonal head bolt that secures the large coupler to the condenser shaft.

The chassis may then be pulled out the rear of the cabinet.

### Hints on Servicing

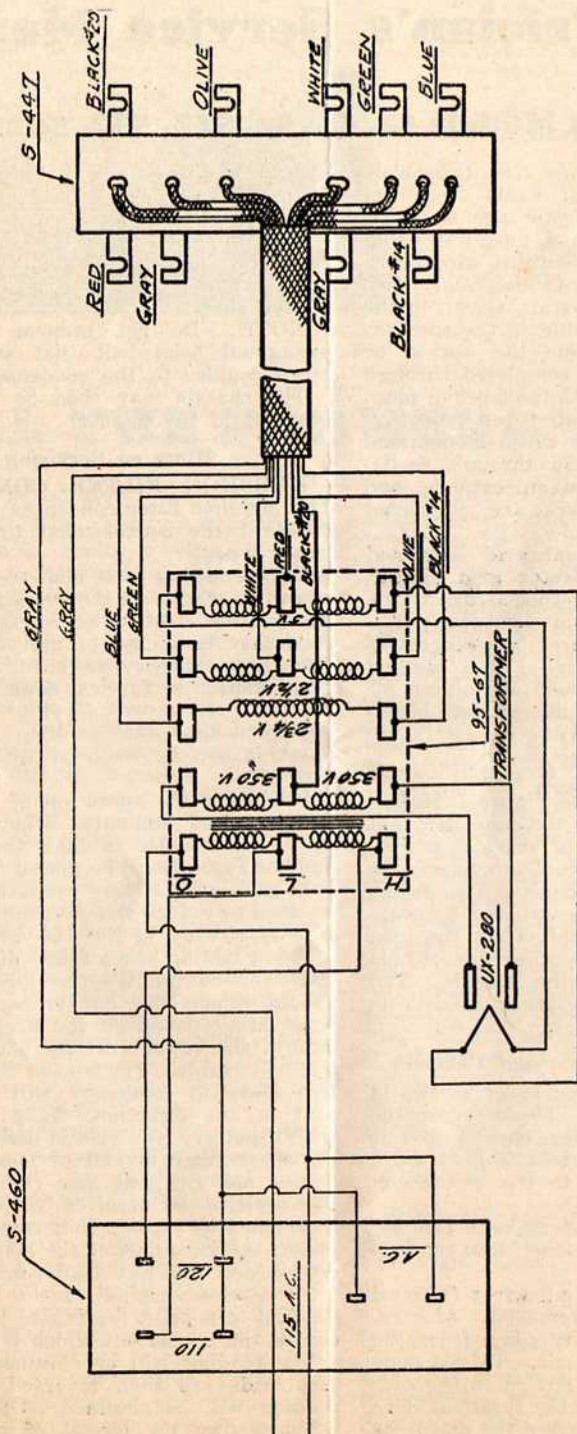
#### MERSHON FILTER CONDENSER.

The Mershon filter condenser is used instead of the conventional tin foil and paper type.

This condenser is as near trouble proof as can be made. In the event that a portion of the electrolytic contents of the condenser is spilled or allowed to leak from the condenser, no harm will result with respect to fabrics, metals or wood finishes. However, a white spot will appear where the solution has been but this can be removed with a damp cloth.

If, during the operation of the set, a frying sound emanates from the condenser, the cause is high line voltage and the fuse should be placed in the 120-volt position. A line resistance should be used to reduce the A.C. supply if the fuse is already in the 120-volt position.

When testing the voltage divider (63-105) for continuity, the Radio-Trician should remember that unless the test leads are touched on the proper terminals of the voltage divider a false reading will result. The reason for this is: The Mershon condenser will pass current in one direction. If a voltmeter with a battery in series is used for testing the voltage divider or Mershon condenser and the test lead running from the positive terminal of the voltmeter is touched to a point that connects with one of the terminals of the Mershon condenser and the test lead running from the negative terminal of the battery is touched to a point leading to the copper can of the condenser, which is negative, a low reading will be obtained. If the test leads are then reversed, the true reading will be obtained. Often times when testing the circuit of the set, a



ZENITH RADIO CORPORATION  
3620 IRON ST., CHICAGO, ILL. A.M.T.  
ZE-50

Figure 2.—Power Pack.

reading will be obtained and the service man may judge that part of the circuit defective, whereas, a reading is being obtained through the condenser.

**Resistance Values**

Parts No.	Resistance	Markings
63-108	50,000 Ohms	Green
63-109	100,000 Ohms	Red or Pink
63-110	400 Ohms	Yellow
63-111	2,000 Ohms	Black
63-112	4,000 Ohms	Blue
63-113	250,000 Ohms	White
63-121	100,000 Ohms	Pink

The voltage divider (63-105) is of 6000 ohms resistance tapped at 850 ohms from one end and 2800 ohms at the other, leaving 2350 ohms at the center section. The center tapped resistor (63-114) is 10 ohms.

a distant one between 200 and 250 meters. The set should be tuned to the station and without further turning the dial, the balancing nuts, starting with the one to the left, turned until the peak of the signal is reached. A tolerance of five meters is allowed between the dial setting and the given wave-length of the station. That is, it may be necessary to rebalance a set so that it is off scale five meters each way from the wave-length of the station, in order to bring the set to the best operating point. The difference in the dial reading may afterwards be corrected by adjusting the dial strip.

**Adjusting Dial Strip**

The dial strip is held in place by the knurled dial segment, which in turn is secured at each end to the drum with

**APPROXIMATE VOLTAGE READINGS**

Type Tube	Position of Tube	"A" Volts	"B" Volts	Control Grid ("C") Volts	Screen Volts	Cathode Volts	Normal Plate M.A.
224	1RF	2.4	175	1	50	2	1.6
224	2RF	2.4	175	2	50	2	1.7
224	DET	2.4	90	5	21	5	0.
227	1AF	2.4	55	2	..	4	1.
227	2AF	2.4	143	13.5	..	14	4.3
227	3AF	2.4	143	13.5	..	14	4.3
245	3AF	2.2	248	45.	..	..	24.
245	3AF	2.2	248	45.	..	..	24.

Line Voltage 115 Fuse in 120-Volt Clips Volume Control in Maximum Position

**Balancing of Set**

The set has been accurately balanced at the factory and should require no further adjustment, but in the event it does become necessary, follow instructions given below.

Rebalancing is done in the same manner as previous models. The Radio-Trician will find, however, that it is not necessary to remove the chassis from the cabinet to make this adjustment.

Through holes in the rear of the condenser shield four hexagonal nuts can be seen. Turning these nuts to the right or left, increases or decreases the capacity of the vernier condensers. The adjusting may be done with a socket wrench of the Spinite type, size No. 5.

Balancing at the factory is done with an oscillator tuned to 203 meters. Since an oscillator is not at all times available, rebalancing may be accomplished with the carrier wave of a station, preferably

two flat head machine screws. There are also three small screws running through the dial strip into the dial segment on the inside of the drum.

The five screws (two large and three small) should be loosened just enough to allow the dial strip to be slipped around the drum under the dial segment. After the dial strip is adjusted to the proper position the screws should be tightened.

**STUDENTS. GRADUATES—**

The monthly Service Manual is a part of our regular consultation service. We hope you find these diagrams and this data helpful. When you write in for consultation service be sure to give us the information we must have to give you quick, accurate service. Be sure to tell us the name, make and model of the set or circuit in question and any other facts about the set that we must have to give you a quick, accurate reply.

J. E. SMITH.

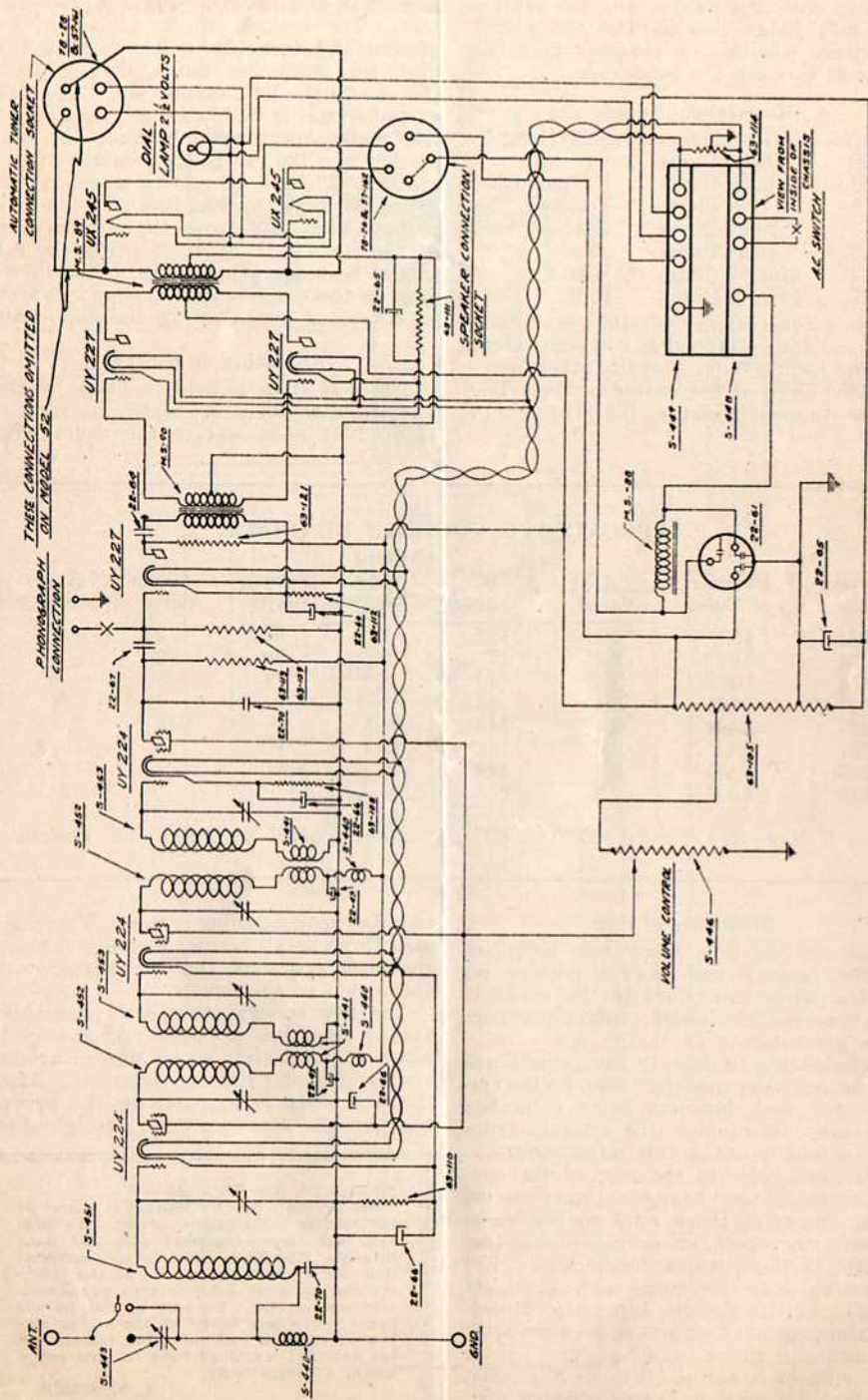


Figure 1.—Circuit diagram of Zenith Receiver, Models 52, 53, 522 and 532.

# National Radio News

Published monthly in the interest of N. R. I. students and graduates, by the

NATIONAL RADIO INSTITUTE  
16th and U Streets, N. W.  
Washington, D. C.

J. E. SMITH, Publisher. E. R. HAAS, Editor.

Copyright, 1930.  
NATIONAL RADIO INSTITUTE

Washington, D. C. January, 1930

## Dr. Lee De Forest Says—

The Radio Industry has assumed such tremendous proportions that a survey of its present situation and a forecast of its future would fill many large volumes.



In every line of human industry in America, Radio is playing a more and more important or indispensable part.

Besides the almost limitless fields of communication, by wire and wireless, telegraph, telephone, photographic and facsimile transference, the railroads now use Radio, in signaling and safety devices. Even passenger elevator installations are beginning to use Radio.

The science of Aviation depends more and more on Radio for signaling and guidance. The multitudinous uses of Radio in marine service are constantly increasing, for direction finding, fog signaling, ticker service, telephone and weather map service on shipboard.

Today Radio is being used to locate ore and oil deposits in the western ranges. Television with its unlimited possibilities is rapidly approaching the dimensions of a great industry.

I have not mentioned the Radio Manufacturing Industry with its \$600,000,000 of annual turnover, its half million or more of employees, operatives, superintendents, managers, engineers and directors. Nor the tens of thousands engaged today in the manufacture, installation and servicing of talking motion picture theatre equipment. Nor the research engineers and laboratory assistants intensively engaged in invention and design of better amplifiers, and acoustic devices—all the direct outgrowth of the Radio, and intimately related to Radio.

With such an astounding situation, such unlimited possibilities and unprecedented opportunities for the young man who is wide awake, ambitious and industrious—need anyone ask advice regarding the possibilities of finding interesting and lucrative employment with a prospect of rapid advancement, in the field of Radio?

It's a fine thing to answer when opportunity knocks at your door, but if it's a little late—don't wait. Get out and stir up your own opportunity.

Training is the best insurance against long hours with low pay!

## Resolutions and Wish-Bones



ANOTHER New Year is here—resolution making time. It's easy to sit by a warm fire, look forward to the year ahead and make a lot of resolutions, but it's quite another thing to carry them out.

There are plenty of men in this world who want to succeed—who want to break away from the old order of things and amount to something. They are the ones who will make the greatest number of resolutions this year and they should, but how few of them will live up to them! They are the never-do-wells—the fellows with WISH-BONES where their backbones were intended to be. They haven't awakened to the fact yet that it's the men who smash through with their ideas and plans that succeed in this world!

I believe that every N. R. I. man is the type of man who makes New Year resolutions, but unlike many others, he carries them out! You have already demonstrated that, for by studying your course you are fulfilling your ambition to make good in Radio. So, as you lay your plans for 1930 with its 365 days brim full of opportunity, RESOLVE to grow with Radio and get your full share of the rewards it has in store for the trained man.

E. R. HAAS,  
Vice President and Director.

## Resistance, Inductance and Capacity Measurements With A Wheatstone Bridge

By JAMES A. DOWIE  
Chief Instructor,  
Member I. R. E.

### PART I

C to D when battery circuit is closed by switch, S. If the instrument, V, registers, this indicates there is a flow of current; if it does not register, there will not be any current flowing between C and D, which means that points C and D are at the same potential. The flow of current between points C and D, depending entirely upon the value of the various resistances, and can be adjusted so as to get certain values from them which will result in no current flowing from C to D.

In other words, by adjusting the values of the different resistances in this Wheatstone Bridge, we are able to bring points C and D to the same electrical potential.

Now suppose such an adjustment of the circuits has been made. The voltmeter, V, will, therefore, not be deflected. Since point, C, is at the same potential (voltage) as point D, it follows that the voltage drop (the difference in voltage between two points in a circuit caused by the resistance) from E to C must be the same as the voltage drop from E to D. But these voltages are given by  $R_1 i_1$  and  $R_3 i_2$ , respectively. Therefore—

$$R_1 i_1 = R_3 i_2 \quad (1)$$

In the same way, the voltage drop between F and C must be equal to the voltage drop between F and D. Therefore—

$$R_2 i_2 = R_4 i_2 \quad (2)$$

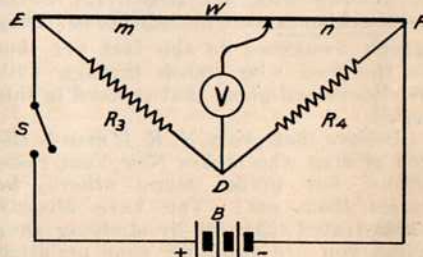


Figure 2.—Circuit of Wheatstone "Slide Wire" Bridge.

These conditions may be expressed as an equation in ratio and proportion. This is read,  $R_1$  is to  $R_2$  as  $R_3$  is to  $R_4$  and means that the ratio of  $R_1$  to  $R_2$  is equal to the ratio of  $R_3$  to  $R_4$ .

This may also be written—

$$\frac{R_1}{R_2} = \frac{R_3}{R_4}$$

If we know the values of  $R_1$ ,  $R_2$  and  $R_4$ , it is easy to find the fourth by the following equation—

$$R_3 = \frac{R_4 \times R_1}{R_2} \quad (3)$$

In other words, by adjusting the resistances  $R_1$  and  $R_2$ , we obtain what is called a "balance" and so determine the value of one resistance, say  $R_3$ , in terms of the other. The point to observe here is that it is necessary to know the ratio between  $R_1$  and  $R_2$ . Knowing this ratio, all we need to know is one resistance,  $R_4$ , and we are then able to determine or measure any unknown resistance  $R_3$ . For example, suppose  $R_1 = 100$  ohms,  $R_2 = 10$  ohms and  $R_4 = 76$  ohms, then the equation—

$$R_3 = \frac{R_4 \times R_1}{R_2}$$

becomes—

$$R_3 = \frac{76 \times 100}{10} = 760 \text{ ohms.}$$

### Wheatstone Bridge With Slide Wire

Now suppose in the place of the resistances  $R_1$  and  $R_2$ , we connect between points E and F as shown in Fig. 2 a length of wire, W, having a high resistance, with a sliding contact from the voltmeter running along the length of the resistance wire, called a "slide wire." This arrangement is frequently used by students or on school lecture tables. It will be observed by comparing Figs. 1 and 2 that these two devices are identical, except that in place of a resistance wire, namely m, in Fig. 2 and in place of  $R_2$ , we have another portion of a resistance, namely, n. However, m and n are a resistance and the proportioning of the resistance of m and n is easily made by means of the sliding contact, which alters the length of wire in m and n, and this alters the resistance.

Thus by simply sliding the contact along the wire, W, we can make an easy adjustment of the resistance m and n, which will result in a balance, that is no current will flow through the voltmeter, V. In this case from equation (3), we have the following—

$$R_3 = \frac{R_4 \times \text{Resistance of wire m}}{\text{Resistance of wire n}}$$

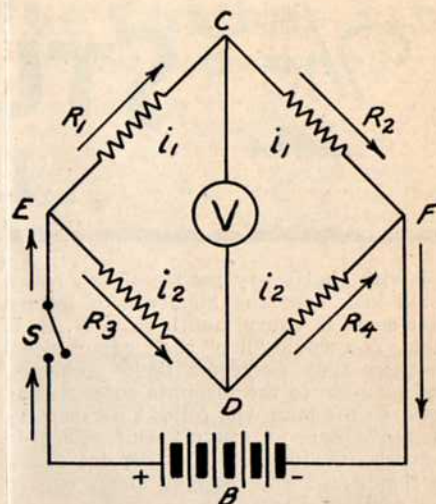


Figure 1.—Circuit of a Wheatstone Bridge.

But, if the entire wire, W, is uniform, the resistance of m is directly proportional to the length of m, and the same thing holds true for n. Thus, the above immediately becomes—

$$R_3 = \frac{R_4 \times \text{length of m}}{\text{Length of n}} = R_4 \times \frac{m}{n}$$

In other words, all we require for such a measuring device is a wire of uniform diameter, along with a sliding contact, one standard resistance  $R_4$ , and an indicating device.

If the wire is laid along the length of a ruler, between E and F say, along a meter stick having 100 divisions, then, no matter where the sliding contact is we can tell at a glance what m and n are.

For example, suppose the slider is moved along the wire, and that a balance is secured at 80, counting from E, Fig. 2, then m is 80 and n is 100 minus 80 or 20. Thus, knowing what  $R_4$  is, and what the ratio of m to n is, we can immediately tell what the unknown resistance  $R_3$  is. This is true regardless of whether the actual values of m and n are known or not. This arrangement is called the Wheatstone "Slide Wire" Bridge, and the above is the theory upon which it operates as far as measurement of plain resistance goes.

The same principle may be used in the measurement of inductance and capacity as employed in Radio work.

I will take up each of these measurements separately using the Wheatstone Bridge method in the News next month.





I wish that every reader of the News could look over the hundreds of letters that come in every month from N. R. I. men. You would "live" their experiences, see how they overcome their problems, and push on to the ultimate success that rewards the man who follows a "success-proven" plan of study. Our space is limited—it's impossible to reprint many of them, so I can tell you about only a few of them here—

Student Ralph Copenhauer of Mt. Orab, Ohio, had some responsibility on his shoulders when he installed and operated the public address apparatus on the steamer Cincinnati on which President Hoover rode and from which he spoke during his recent cruise down the Ohio River. As many as 100,000 people heard the President's address over this apparatus several times during that trip. A fellow doesn't mind that kind of responsibility, though, if he is equipped to deliver the goods. Copenhauer was!

From all accounts the sales and service supervisor of the Brooklyn Radio Company is an up and coming Radio man. That's student Gabriel S. Loudoux. He's cleaning up on the new screen-grid sets.

Judging from the Radio section of the New York Sun and several Radio magazines, Graduate Osgood of West Orange, New Jersey, is quite a technical Radio writer these days. It's one thing to know Radio and quite another thing to write authoritative articles on the subject. Osgood does!

Student Louis C. Harder is another N. R. I. man who is showing what confidence and determination will do. He writes, "I am now employed by the local jobbers of 'Radiola' and 'Earl' Radios, thanks to you, Mr. Smith. When I started my Radio course many of my friends said I was very foolish—it was impossible to learn Radio by mail, but if that was foolish, I want to continue to be foolish as it has proved very profitable for me."

If some of you knew Student James T.

Stagg, Pratt City, Alabama, well—anyway he has a sure enough difficulty to overcome—his legs are paralyzed, yet he is going right ahead and making money in Radio! He makes all of his service calls with the help of an assistant who assists him in and out of his car and does some of the heavier work for him. Stagg's determination to overcome obstacles ought to be an inspiration to many of us who think we have difficulties. Most of ours are imaginary—if we ran into a real one we would find out what "grit" and stick-to-it-ive-ness mean.

Student H. W. Moon of Aberdeen, S. Dak., is one of several who have put high prices on the course's value. He writes, "Your course so far is worth far more than its cost to me. I would not part with the training I already have for \$1,000. It will make me that much more this winter." There are plenty of fellows in this country who would like to make the cost of their training ten times over in less than one year. Yes—plenty of them, but they wait and wish. They don't realize it's action that counts nowadays!

If you want to know anything about the Spartan set or what it means to be a Spartan dealer, get in touch with Graduate Wilmoth, Sales Manager for the Sparks-Withington Co., Jackson, Mich. Wilmoth says that Spartan is going over big. Training will tell!

Here's how Student W. F. McCool, 2315 N. Monroe, Spokane, Washington, is getting on in Radio. Read his letter:

"When I enrolled I was employed in a garage as a mechanic. On the 1st of September I left the garage and since then I have spent all of my time with Radio.

"In August I made \$184.85 profit from my Radio work in spare time only. I had my repair shop at my home. Then I decided to open a Radio store. On the first of October I received my franchise from Silver-Marshall and also the first of six receivers. To date I have sold 16 receivers and also sold 7 out of the 9 used receivers that I took in as part payment. Then I was appointed as the official Service Station for Silver Radio in the eastern half of the State of Washington and the State of Idaho.

"As to the repair work, since I opened my store at 2315 N. Monroe, I have had to employ a serviceman in the shop and another to do the outside work. I have the service work and the installing of receivers from six small Radio stores to handle in addition to my own.

"During the month of September I was handling all of my own work and now I have two service men, and four salesmen employed. I have paid for all of the merchandise, material, equipment, and wages for October and I find that my profits for the month are over the \$1,000 mark.

"I am in Radio to stay as I believe it is the largest field today and in the future for EXPERIMENTS, INVENTIONS and PROFITS."

## Don't Overlook The Custom Job

(Did you notice carefully picture on the cover?)

Imagination plays its part in the success of any man or business. The man who built the rather unique set shown on the cover of this issue had imagination. He capitalized on a clever idea. That set was built for a hunting lodge and it shows to what length one may go in carrying out the custom-built scheme. Does that picture give you a money-making idea?

Survey your community and you'll probably find a number of prospects for specially designed and built receiving apparatus. Isn't it true that many people want a distinctive type of set—a set that expresses individuality and matches their own surroundings? That's what makes it so profitable for the man who gets a clever idea in custom set building and puts the job over!

Amusement centers, skating rinks, lodges, inns, roadside refreshment stands, country clubs, country homes—any number of places of that nature are good prospects for distinctive types of Radio equipment. Think the matter over—plan some suitable design or model for prospects of the type mentioned above, and then go after it and put the idea across. You'll find it well worth your while. It will make a neat profit for you as well as a reputation as a Radio man with originality and skill.

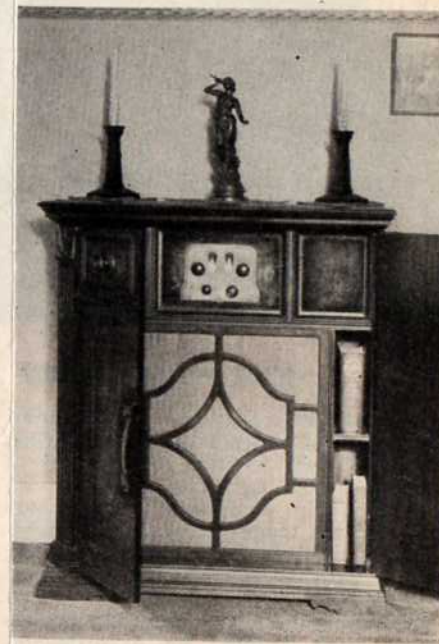
Aside from unique and the odd sets keep an eye on that discriminating class of people who want the very finest—something that expresses their own personality. Don't overlook any chance to design and install a set in a truly fine piece of furniture for that type of prospect.

"I am happy to say that although it is less than two months since I enrolled for the N.R.I. course, the knowledge which I have gained in this short space of time was sufficient to enable me to land a job as Radio Trouble Shooter, with the Philco Storage Battery Co., and at twice the salary which I was earning at my last job. In addition to the increased salary there is plenty of room for advancement."—Stanley Allen Moss, 2651 S. Fairhill St., Philadelphia, Pa.

"Repairing pays me as high as \$15 a day and my sales average about two sales a week. I'm very busy, too busy to study my lessons. I'm only sorry I didn't take my course sooner, so I could devote all my time to business and render better service. I'm going to employ two men in a few days to assist me in my sales and repair work."—John Fandrick, Devil's Lake, N. Dak.

The men at the top of the success ladder didn't get there in one jump. Success comes by mastering one job at a time. It's the doing of little things well that leads one to the bigger jobs.

The picture below shows a fine custom job that netted Graduate F. H. Perau, 771 Amherst St., Buffalo, N. Y., exactly \$500. It is a splendid piece of craftsmanship. Mr. Perau writes that he has about two custom set jobs each month, which goes to show there's good money for the technical man with a little imagination and the desire to pick up the jobs.

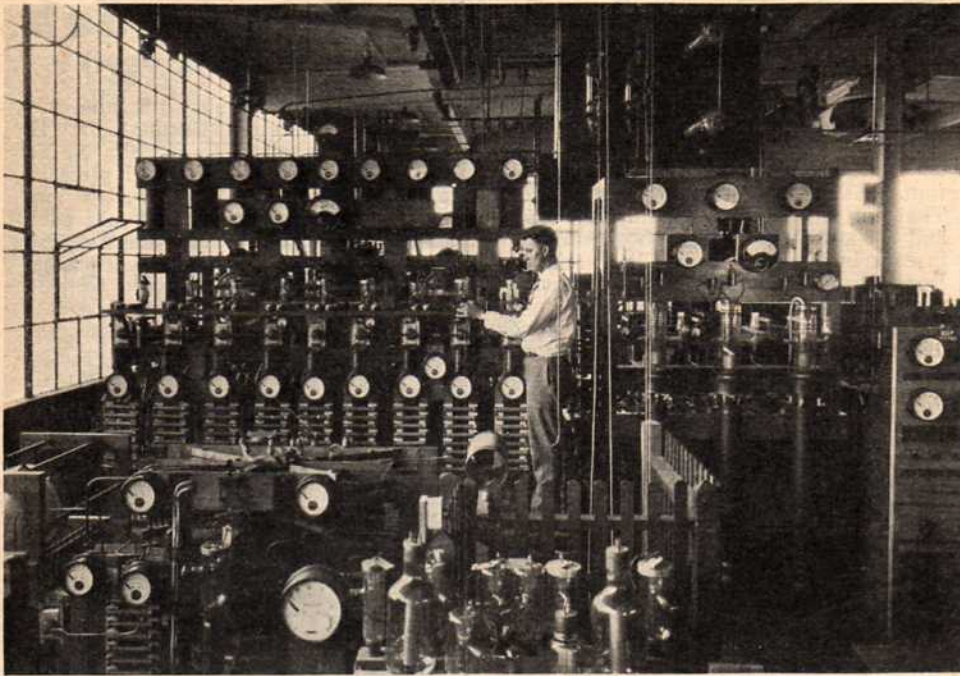


"I have been over-rushed with Radio work for the last 4 months. In one month I netted a profit of \$200.00 in my spare time, and the way things are going now I might have to put a man to work to get out of the rush."—Mr. Louis Wesp, 50 Bay Ave., Jamaica Creek, Springfield, L. I., New York.

### NEXT MONTH

THE NEWS will carry the full story of the founding of the National Radio Institute Alumni Association—the first Alumni Association of a home study school ever founded! You will be interested in the details—watch for next issue.





### THE 100,000 WATT APPARATUS AT WGY

Men who know, say that we are entering an era of super-power broadcasting. It would seem so from the number of stations increasing their power and enlarging their equipment. The more powerful the transmitter, the less sensitive the receiver must be and the less trouble with interference set up by outside agencies.

The General Electric Company has recently been granted an experimental license by the Federal Radio Commission to operate a 200,000-watt station. That is a far cry from the old 100-watt sta-

tions that used to be considered "the thing" in Radio broadcasting. Equipment of the kind shown in the above picture costs plenty of money, and it is not going to be turned over to men who have learned their Radio by the hit-and-miss method—such equipment must be operated by men who know their Radio. The N.R.I. is well represented in the broadcasting field by its graduates. The latest check-up shows that N.R.I. men are operating in around 90 stations. They are doing their part in putting Radio over.

—Editor.

Give your best friend a boost in 1930. Start the New Year out right by helping him make good. Many successful men today owe their success to the boost that some friend gave them years ago. So send me the name of your best friend and let's help him get started out in Radio. I'll shoot the proof to him—you'll earn his everlasting gratitude as well as your commission.

—J. E. S.